

Review Paper Batteries: Paper Thin Power

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Abstract: Historically, we are able to discuss concerning physics are designed round the batteries. In recent years, a brand new battery in this case we tend to know the paper battery, has been developed which will simply adapt to the dimensions and form of assorted physics. The paper battery is changing into progressively vital as technology tends towards agent and more paper-like devices. This paper can embrace a technical discussion of however the paper battery works. It assess the potency and explore the benefits of recent developments within the fabrication of paper batteries. Many applications of the paper battery can then be delineate, and moral problems that arise with it'll be explored.

INTRODUCTION:

A paper battery could be a versatile, ultra-thin energy storage and production device fashioned by combining fullerene s with a traditional sheet of cellulose-based paper. A paper battery acts as each a high-energy battery and Super capacitor, combining 2 parts that area unit separate in ancient physics paper battery is an electrical battery designed to use a spacer fashioned for the most part of polysaccharide (the major constituent of paper). It incorporates Nano scale structures to act as high surface-area electrodes to boost conduction.

In addition to being outstandingly skinny, paper batteries square measure versatile and environmentally-friendly, permitting integration into a good vary of merchandise. Their functioning is comparable to standard chemical batteries with the necessary distinction that they're non-corrosive and don't need in depth housing.

History:

In December 2009 at Stanford, Yi Cui and his analysis team with success unreal the first operating epitome that gives one.5 V as its terminal voltage. A paper battery is Associate in nursing ultra-thin, environmentally friendly and versatile

Energy voltaic battery manufactured from carbon Nano tubes and paper.

Paper Batteries: the Way for Thinner Electronics.

Electronic devices have evolved from giant desktop Computers to compact pocket-sized good phones capable of running various applications; as technology slims down, engineers should realize the simplest way to pack a lot of power into smaller areas. One innovative answer is that the paper battery. The recent development of the paper battery utilizes carbon nanotubes as electrodes associated an integrated style of layers of electrolytes to form a skinny and versatile battery. The paper battery is very important because it may open up potentialities for good labels, medical devices, and electronic displays in advertising. The paper battery distinguishes itself from different batteries in

its use of carbon nanotubes, which allow for electrical efficiency and effective use of space, the details of which will be discussed in the following sections.

Nanotechnology permits for Innovative Design:

A Technical Discussion In order to know the novelty of the paper battery, it's vital to 1st scrutinize the look of ancient batteries.

Then, through comparison, it'll be attainable to ascertain the benefits that the slight changes from battery to paper battery bring.

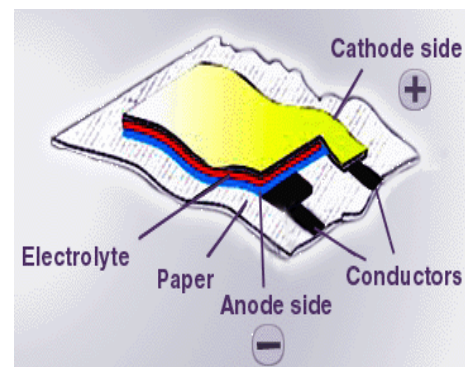
Back to the Basics:

A Review of the Traditional Battery Traditionally, batteries area unit created of a negative conductor, referred to as associate anode, and a positive conductor, referred to as a cathode.

These electrodes take up the bulk of the area within the battery. They are separated by associate solution that in ancient batteries is typically a liquid resolution. This is often embedded during a apparatus. The apparatus prevents the anode and cathode from touching, however still permits electrons to be transferred between the Charge collectors manufactured from metal sheets, meshes, or films offer charge transport to the battery's terminals, therefore permitting the Electrical energy to be transported to whatever device is attached to the battery.

Electrolytes:

This polysaccharide primarily based spacer is compatible with several doable electrolytes. Researchers used ionic liquid, primarily a liquid salt, because the battery's solution, furthermore as present electrolytes like human sweat, blood and excreta. Use of associate ionic liquid, containing no water, would mean that the batteries wouldn't freeze or evaporate, doubtless permitting operation in extreme temperatures.



The Mechanics of Paper Batteries:

Like ancient batteries, paper batteries conjointly incorporates two electrodes, associate degree solution, a centrifuge, and charge collectors. However, in contrast to ancient batteries, paper batteries have one conductor product of semi conductive carbon Nano tubes, the centrifuge is formed from plant polysaccharide (the main ingredient in paper), and therefore the second conductor is formed by coating the alternative aspect of the paper centrifuge with Li compound. to supply the solution, the paper is saturated with associate degree ionic liquid – that's, associate degree organic salt that's liquid at temperature. Since the ionic liquid doesn't contain water, the batteries don't contain something that may freeze or evaporate, facultative them to face up to extreme temperatures, starting from -78°C to 177°C. Also, since the battery is dry, it doesn't want a sealed case, as do ancient batteries. It conjointly doable to create an excellent condenser from the carbon conductor and paper centrifuge by folding it in thus that the paper is within the middle and each the highest and bottom electrodes area unit carbon. One such postage-stamp-sized super condenser includes a voltage of just about two.5 volts, which is comparable to different normal super capacitors that area unit abundant larger.



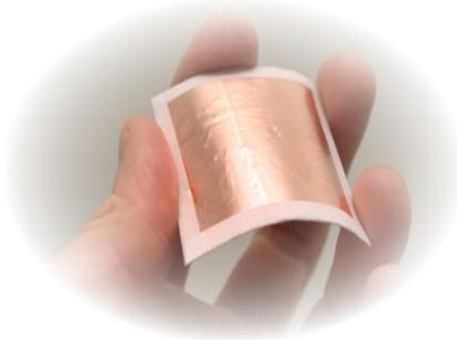
Formation:

1. Combining carbohydrate with degree infusion of aligned carbon nanotubes that unit each just about one millionth of a metric long measure thick
2. These very little filaments act a bit like the electrodes found throughout a ancient battery, conducting electricity once the paper comes into contact with degree ionic liquid resolution.
3. With no water in resolution, cannot freeze and thence operating employee -75 to 1 hundred degree.

Flexible Battery:

Flexible batteries, every primary and secondary ones batteries that designed to be conformal and versatile, whereas the quality batteries rigid with positive shapes. The increasing interest in mobile versatile and versatile natural

philosophy has semiconductor diode to the event of versatile batteries which can be implemented in product like wise cards, wearable natural philosophy, novelty packaging however as versatile displays and transdermal drug delivery patches. Thence efforts current to form utterly completely different versatile power sources at the side of primary and reversible batteries.

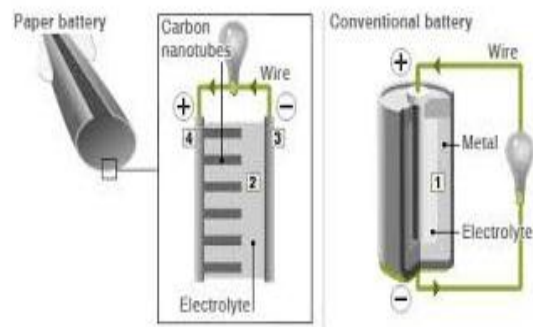


Manufacturing:

Growing the nanotubes on a Si substrate then impregnating the gaps inside the matrix with carbohydrate Once the matrix has dried, the material is also naked as a of the substrate.

Working:

Internal operation of paper batteries is analogous to it of standard batteries with every battery generating regarding one.5V.If one will recall ancient batteries add the style wherever positive charged particles known as ions and negative charged particles known as electrons move between positive conductors known as anode and negative electrode known as cathode. Current flows as electrons be due anode to the cathode through the conductor, since the solution is associate stuff and doesn't offer a free path for electrons to travel.



Working of Paper Batteries:

Chemical reaction between metal and answer lands up } in production of ions whereas action between carbon and answer ends up in production of electrons. These electrons result the cathode to the anode through the external circuit 5 necessary reasons but Paper Batteries square measure beyond their typical Counterparts:

1. Paper batteries have long lasting time.
2. They are non-ototoxic as they are doing not involve harmful chemical reactions.

3. They are versatile and may be rolled or cut with none impact on their efficiencies. This can be as a result of the actual fact that they're created of materials like polysaccharide and carbon nanotubes that have high lastingness.
4. They are disposable as they're created of polysaccharide that is bio degradable and non-ototoxic.
5. They will be employed in harsh climate conditions like heat and cold. this can be as a result of the solution doesn't involve water that makes the battery operate within the vary of -73 to 149 degree.

Where can Paper Batteries be used:

Paper battery can actually prove useful for applications where immovableness' and size is that the most demand. modern instrumentality like smart cards, digital watches facilitate the necessity of thin batteries that unit of measurement long lasting and non-toxic. Computers one among the foremost recent real time samples of wearable computers is Google Glass. It actually may be a standard spectacle with AN optical head mounted show And Glass may be a laptop computer inside the sort of a strive of eyeglasses and includes an optical head-mounted show that allows the user to use a wise phone. It's going to even be used for low power devices like calculators, joint plane watches and wireless communication devices like mouse, Bluetooth headphones, keypads etc.

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